Airfield Surveillance Radars (ASR)

An **airport surveillance radar (ASR)** is a [radar](https://en.wikipedia.org/wiki/Radar) system used at airports to detect and display the position of aircraft in the terminal area, the airspace around airports. The sophisticated systems at large airports consist of two different radar systems, the primary and secondary surveillance radar. The primary radar typically consists of a large rotating [parabolic antenna](https://en.wikipedia.org/wiki/Parabolic_antenna) that sweeps a vertical fan-shaped beam of [microwaves](https://en.wikipedia.org/wiki/Microwave) around the airspace surrounding the airport which detects the position of aircraft. The [secondary surveillance radar](https://en.wikipedia.org/wiki/Secondary_surveillance_radar) consists of a second rotating antenna, often mounted on the primary antenna, which interrogates the [transponders](https://en.wikipedia.org/wiki/Transponder) of aircraft, which transmits back the aircraft's identification and altitude which is displayed on the radar screen next to the return from the primary radar. (From Wikipedia)[[1]](#footnote-1).

Examples in the U.S.:

Airfield Surveillance Radar ASR-9[[2]](#footnote-2)

Manufacturer: Westinghouse Electronics, (now: [Northrop Grumman Corporation](http://www.radartutorial.eu/logos/hersteller.html#northrop) Electronic Sensors and Systems Division, Baltimore, Maryland)

The Northrop Grumman ASR-9 is an advanced radar system, which has been operational at 135 U.S. locations and was the first airport surveillance radar to display weather and aircraft simultaneously. The first installation began in 1989 and was completed in 1995.

ASR-9 Tower
(© MIT Lincoln Laboratory)

Figure 2: Equiped with different beacon ASR-9 antenna

The ASR-9 combines circular [polarisation](http://www.radartutorial.eu/06.antennas/Polarization.en.html) with moving target detection for vastly improved aircraft detection in weather. A separate weather channel generates six weather levels, any two of which may be selected at one time by the controller. For detection of small targets in severe clutter, the ASR-9 employs a dual-beam antenna (Transmit in low beam only), advanced digital processing, sophisticated constant false alarm rate circuitry, and a scan-to-scan tracker. A clutter processor with a fine grain clutter map enhances returns from tangentially flying aircraft.

The system is completely unattended, incorporating a remote maintenance and monitoring system, and has a dual-channel mean time between failure of over 3,500 hours. Should a fault occur, a built-in test detects and isolates the problem, a capability that can be controlled from a central facility. Redundancy has also been incorporated in the antenna subsystem by the use of dual- drive motors and dual- azimuth pulse generators.

[ASR-9
(Click to enlarge: 608·480px = 179 kByte](http://www.radartutorial.eu/19.kartei/pic/img2031.jpg)

Figure 1: ASR-9 Tower   
(© MIT Lincoln Laboratory

[http://www.radartutorial.eu/logos/Westinghouse.png](http://www.radartutorial.eu/logos/hersteller.html#wh)

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| --- | --- |
| **Specifications** | |
| frequency: | 2.7 to 2.9 GHz |
| pulse repetition time (PRT): |  |
| pulse repetition frequency (PRF): | 325 to 1200 pulses per second |
| pulsewidth (τ): | 1 microsecond |
| receive time: |  |
| dead time: |  |
| peak power: | 1.3 Mwgawatt |
| average power: |  |
| instrumented range: | up to 60 nm |
| range resolution: | 450 ft |
| beamwidth: | 1.4 degrees |
| hits per scan: |  |
| antenna rotation: | 12.5 rpm |

**Airport Surveillance Radar (ASR-11)[[3]](#footnote-3)**

This from the FAA ASR-11 website



Abilene ASR-11 radar antenna



Abilene ASR-11 radar antenna

**Program:**

Airport Surveillance Radar (ASR-11) is an integrated primary and secondary radar system that has been deployed at terminal air traffic control sites. It interfaces with both legacy and digital automation systems and provides six-level national weather service calibrated weather capability that provides enhanced situational awareness for both controllers and pilots.

**Status:**

The ASR-11 has completed deployment.

**Primary and Secondary Surveillance Radar:**

The primary surveillance radar uses a continually rotating antenna mounted on a tower to transmit electromagnetic waves that reflect, or backscatter, from the surface of aircraft up to 60 miles from the radar. The radar system measures the time required for radar to echo to return and the direction of the signal. From this, the system can then measure the distance of the aircraft from the radar antenna and the azimuth, or direction, of the aircraft in relation to the antenna. The primary radar also provides data on six levels of rainfall intensity and operates in the range of 2700 to 2900 MHz. The transmitter generates a peak effective power of 25 kW and an average power of 2.1 kW. The average power density of the ASR-11 signal decreases with distance from the antenna. At distances of more than 43 feet from the antenna, the power density of the ASR-11 signal falls below the maximum permissible exposure levels established by the Federal Communications Commission (FCC).

The secondary radar uses a second radar antenna attached to the top of the primary radar antenna to transmit and receive area aircraft data for barometric altitude, identification code, and emergency conditions. Military, commercial and some general aviation aircraft have transponders that automatically respond to a signal from the secondary radar by reporting an identification code and altitude. The air traffic control uses this system to verify the location of aircraft within a 60-mile radius of the radar site. The beacon radar also provides rapid identification of aircraft in distress. The secondary radar operates in the range of 1030 to 1090 MHz. Transmitting power ranges from 160 to 1500 watts.

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1. https://en.wikipedia.org/wiki/Airport\_surveillance\_radar [↑](#footnote-ref-1)
2. http://www.radartutorial.eu/19.kartei/karte203.en.html [↑](#footnote-ref-2)
3. http://www.faa.gov/air\_traffic/technology/asr-11/ [↑](#footnote-ref-3)